3GPP TSG-RAN WG1 Meeting #102e draft R1-20xxxxx

e-meeting August-17th -28th 2020

Agenda Item: 7.2.8

Source: Moderator (Ericsson)

Title: Feature lead summary for maintenance of UL SRS and L1 procedures for NR positioning

Document for: Discussion

# 1 Introduction

This document is based on the feature lead summary for NR positioning maintenance AI 7.2.8[1], and tracks the progress of the discussion for aspects 14-18 and 22 as stated in the chair notes:

[102-e-NR-Pos-02] Email discussion/approval on UL SRS and L1 procedures focusing on aspects 14-18 and 22 in the FL summary until 8/21; if necessary, endorse remaining TPs by 8/27 – Florent (Ericsson)

The following aspects are treated:

* Aspect #14: SRS Configuration
* Aspect #15: AP- SRS Support
* Aspect #16: MAC CE for SP/AP SRS Spatial Relation Indication
* Aspect #17: UE Sounding Procedure - Alignment of Parameter Names
* Aspect #18: Prioritization for Transmission Power Reduction
* Aspect #22: Priority of SRS for Positioning

# 2 Discussion

## 2.1 Aspect #14: SRS Configuration

In [[9] Huawei], it is proposed to add BWP and carrier information to NRPPa. It is also proposed to reflect potential agreements in an LS to RAN3.

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| ***Proposal 2: Include the carrier information and active BWP information in the SRS configuration.***   * ***Carrier information includes one or more UL carriers, each containing***   + ***PCI***   + ***SFN Initialization time***   + ***PointA position***   + ***Usable RBs for each subcarrier spacing (Resource grid)*** * ***Active BWP information, containing***   + ***BWP location and bandwidth***   + ***Subcarrier spacing***   + ***CP type***   + ***Tx DC location***   + ***7.5kHz shift*** |

Feature lead proposal 1: the following information is added to the SRS configuration IEs sent by the gNB to the LMF:

Carrier information includes one or more UL carriers, each containing

- PCI

- SFN Initialization time

- PointA position

- Usable RBs for each subcarrier spacing (Resource grid)

Active BWP information, containing

- BWP location and bandwidth

- Subcarrier spacing

- CP type

- Tx DC location

- 7.5kHz shift

Companies are encouraged to provide their feedback on the feature lead proposal in the comment section below.

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| Company | Comment |
| Nokia/NSB | Shouldn’t the NRPPa information follow both RRC spec and the higher layer parameter LS that RAN1 sent to both RAN2/RAN3? Or is there additional information in the proposal that RAN3 needs to be informed of? |
| Huawei/HiSilicon | RRC parameters only concern parameters under SRS-Config. The point is SRS-Config is indicated the following ASN.1 structure.  ServingCellConfig (in RRCReconfiguration)  🡪 UplinkConfig (uplinkConfig/supplementaryUplink)  🡪 BWP-Uplink (uplinkBWP-ToAddModList)  🡪 BWP-UplinkDedicated (bwp-Dedicated)  🡪 SRS-Config (srs-Config)  There is additional information conveyed by RRCReconfigurationComplete (from UE to gNB) on UL DC indication.  The information is hard for RAN3 to extract from the whole RRC spec, which has strong correlation with RAN1. |
| CATT | If all the information mentioned in FL proposal 1 had been included in RRC spec, it is no need to repeat them in NRPPa spec. |
| Huawei/HiSilicon2 | We would like to remind the group that the only WI that has exception in RAN3 is NR positioning, and we should provide assistance in our best effort to help RAN3 finish their work. Clearly we do not need to transfer the entire RRCReconfiguration message in NRPPa, and what information is needed for receiving SRS is RAN1 expertise, e.g. how the first RB of SRS is counted, whether Tx DC location is needed, whether 7.5kHz shift is needed. |
| Qualcomm | We think that Ran3 will benefit from RAN1 input. Similar view with HW, that currently, there is no Tx DC location nor 7.5 KHz shift in the latest NRPPa draft. These 2 would need to be included. Looking at the latest draft, it seems the PointA, offset-To-carrier, BWP-offset, SRS config are added, along with all the remaining parameters.  So, at least informing them that Tx DC location and 7.5 Khz shift is needed also, would be beneficial.  To HW/HiSi: The remaining information of the above proposal seems already included in the latest NRPPa draft right? |
| Huawei/HiSilicon | To QC:  Yes they are; however, we suggest to adopt the fields that are used in RRC to facilitate gNB internal processing and better understand the field without new explanation, which induces the following change   * offset-To-carrier 🡪 Usable RBs for each subcarrier spacing (Resource grid) * BWP-offset 🡪 BWP location and bandwidth |

## 2.2 Aspect #15: AP- SRS Support

In [[9] Huawei], several issues pertaining to aperiodic SRS support are discussed:

Issue with triggering of aperiodic SRS, based on a DCI codepoint sent by the LMF:

- whether the LMF can “order” the gnodeB to send the SRS triggered by the code point in the LMF message.

- whether the gnodeB should trigger all SRS (including SRS mimo and SRS for positioning) associated with the DCI code point

Issue with the understanding of the transmission instant for neighbouring gnodeBs:

~~- The serving gnodeB should send additional information regarding the delay between the DCI and the actual SRS transmission (slot offset) to the LMF for forwarding to measurement neighboring nodes.~~

- The offset between DCI and triggered SRS transmission (slot offset) may not be useful for LMF or measurement neighbouring nodes as they do not detect DCI.

- The serving gnodeB should send additional information regarding the actual SRS transmission timing to the LMF for forwarding to measurement neighboring nodes.

The following is proposed:

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| ***Proposal 4: Send a reply LS to RAN3 on the problem of providing the following two parameters in NRPPa, and recommend to adopt the SFN and slot number of the AP-SRS to be transmitted instead.***   * ***aperiodicSRS-ResourceTriggerList*** * ***slotOffset*** |

Feature lead proposal 2: When using aperiodic SRS in positioning methods:

- The LMF is informed of the aperiodic SRS configuration by:

Option 1: the gNodeB transmits a list of code points the LMF can choose from, and the LMF can, at the moment of transmission, request any of the code points to trigger SRS.

Option 2: the LMF request aperiodic transmission (which may include a proposal for an appropriate code point) and the gNodeB responds by providing the code point used to the LMF. The code point may differ from the LMF recommendation

- the gNodeB should include slotOffset (including slot number and SFN) as part of the aperiodic SRS information sent to the LMF.

- Send a reply LS to RAN3 reflecting the agreement

Companies are encouraged to provide their feedback on the feature lead proposal in the comment section below.

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| Company | Comment |
| Nokia/NSB | Our understanding is that Option 2 is what was intended to be supported and that RAN3 was not deciding that LMF would have radio resource control. Positioning Activation Request should only be considered a recommendation. |
| Huawei/HiSilicon | We suggest to break the discussion into the following two orthogonal issues.  Issue #1: Actual SRS transmission timing for TRP measurement. (**Example:** DCI will be sent in slot#2 of SFN#2, slot offset for AP-SRS triggering is 4 slots, which means that SRS will be transmitted in slot#6 of SFN#2).   * Option 1: Based on existing signaling, i.e. slot offset with respect to the triggering DCI. In the example, TRP will be aware of the slot offset 4. * Option 2: Specific slot number and SFN when SRS will be triggered. In the example, TRP will be aware of the slot/SFN number slot 6 of SFN#2.   Issue #2: SRS triggering codepoint information between LMF and the serving gNB   * Option 1: the gNodeB transmits a list of code points the LMF can choose from, and the LMF can, at the moment of transmission, request any of the code points to trigger SRS. * Option 2: the LMF request aperiodic transmission (which may include a proposal for an appropriate code point) and the gNodeB responds by providing the code point used to the LMF. The code point may differ from the LMF recommendation |
| ZTE | We support both Option 2 from Huawei’s proposals. |
| CATT | First of all, we want to clarify the SRS mentioned in FL’s proposal or above Huawei’s two options refer to only SRS-Pos or both SRS-Pos and SRS-MIMO? |
| LG | We are fine with the FL’s proposal and we think that decision of option 1 or 2 can be up to RAN3. In our understanding, this discussion is only for SRS for positioning. |
| Huawei/HiSilicon2 | In reply to CATT:  Our understanding is that it depends on the functionality supported in NRPPa. If NRPPa supports both AP-SRS-MIMO and AP-SRS-Pos, then the two issues should be applicable to both SRS.  From our side, the general information on how SRS timing is transferred to the non-serving cell, and on how SRS triggering codepoints are exchanged between LMF and the serving cell should be provided by RAN1. |
| CATT | If the SRS mentioned in FL’s proposal or above Huawei’s two options maybe refer to AP-SRS-MIMO (depends on the functionality supported in NRPPa), we suggest to add Issue #3:  Issue #3: For the SRS mentioned in Issue#1 and Issue#2, it refer to:   * Option 1: Only SRS-Pos; * Option 2: both SRS-Pos and SRS-MIMO (depends on the functionality supported in NRPPa); |

Based on the first round of feedback, it seems that more details need to be discussed on how the trigger is forwarded to the non-seving gnodeB. The following revised proposal is given:

Feature lead proposal 2a:

Issue #1 When using aperiodic SRS in positioning methods:

- The LMF is informed of the aperiodic SRS configuration by:

Option 1-1: the gNodeB transmits a list of code points the LMF can choose from, and the LMF can, at the moment of transmission, request any of the code points to trigger SRS.

Option 1-2: the LMF request aperiodic transmission (which may include a proposal for an appropriate code point) and the gNodeB responds by providing the code point used to the LMF. The code point may differ from the LMF recommendation

Issue #2: Actual SRS transmission timing for TRP measurement. To notify the non-serving gnodBs of the slot where the aperiodic SRS is transmitted

- option 2-1: based on existing signalling, i.e. slot offset with respect to the triggering DCI. The non-serving node receives the slot/SFN number where DCI is transmitted, and is aware of the slot offset between DCI and SRS transmissions.

- option 2-2 the signalling to the non-serving gnodeB includes the specific slot number and SFN when SRS will be triggered

- Send a reply LS to RAN3 reflecting the agreement

Companies are encouraged to provide their feedback on the feature lead proposal in the comment section below.

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| Company | Comment |
| Qualcomm | Our understanding of the procedure:   * Step 1: Serving gNB sends all codepoints to LMF. Then LMF picks one of those.   + In other words we support, Opt. 1.1 * Step 2: Serving gNB sends to LMF the *slotoffset* part of the SRS config as it is already in in RRC (0..31). LMF sends the codepoint with absolute time (Activation time) of where SRS should be transmitted.   + **We dont see a proposal for that aspect above** * Step 3: LMF sends absolute time (in seconds) to the Neigboring gNB of where SRS is transmitted.   + In other words we support, Option 2.2; no need to send slotoffset with respect to the DCI to the neighboring cell. A generic/absolute time is enough. |
| Huawei/HiSilicon | We support Option 1-2 and Option 2-2.  Reply to QC:  In step 2, we do not think the following absolute time is feasible.   * Step 2: Serving gNB sends to LMF the *slotoffset* part of the SRS config as it is already in in RRC (0..31). LMF sends the codepoint with absolute time (Activation time) of where SRS should be transmitted.   + **We dont see a proposal for that aspect above**   LMF cannot order gNB in which slot to send the DCI, simply because it is not in controlled by LMF (LMF does not know the slot format, or the search space configruation, or the DRX state, or the gNB resource assignment, and LMF is in 5GC instead of NG-RAN), and decision when to send the DCI should be up to gNB implemtantion. The so-called absolute time should only be understood as a rough time window recommendation, and gNB should respond an actual time when DCI will be sent or when SRS will be triggered, which will be later forwarded to the neighbouring gNB in the form of absolute time of SRS transmision. |
| CATT | We would like to add Issue #3 based on Feature lead proposal 2a, as follows,  Issue #3: For the AP-SRS mentioned in Issue#1 and Issue#2, it refer to:   * Option 1: Only AP-SRS-Pos; * Option 2: both AP-SRS-Pos and AP-SRS-MIMO (depends on the functionality supported in NRPPa);   From the 1st round discussion, at least one company(LG) prefer the AP-SRS mentioned in Issue#1 and Issue#2 only refer to SRS-Pos, but Huawei think it includes both AP-SRS-Pos and AP-SRS-MIMO, therefore, we had better to clarify what is the exact meaning of AP-SRS in the FL proposal 2a.  In our point of view, maybe we can only include AP-SRS-Pos at current stage, not sure whether there are potential issues when it include both AP-SRS-Pos and AP-SRS-MIMO.  For Issue #1, we prefer this issue should be discussed in RAN2.  For Issue #2, we prefer Option 2-2, i.e., TRPs should know both slot offset and SFN. |

## 2.3 Aspect #16: MAC CE for SP/AP SRS Spatial Relation Indication

Rel.16 MIMO agenda has introduced a new MAC CE to update the spatial relation info of SP/AP SRS. But there is no conclusion on whether the above agreement can be applicable to positioning SRS. In addition, the MAC CE defined in clause 6.1.3.26 of TS 38.321 doesn’t support to update spatial relation info of SP/AP positioning SRS. Two companies propose to correct the issues via two similar text proposals:

* in [4] the following TP for clause 6.2.1 of the TS 38.214 specification propose to make the MAC CE update of the spatial relation only applicable to SRS resources belonging to an *SRS-ResourceSet* (i.e. a set configured for mimo)

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| **TP 2.3A**  ========================unchanged parts omitted================================  when a UE receives an spatial relation update command, as described in clause 6.1.3.26 of [10, TS 38.321], for an SRS resource configured by *SRS-ResourceSet*, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set.  ==========================unchanged parts omitted============================== |

* in [8] the following TP for clause 6.2.1 of the TS 38.214 specification propose to make the MAC CE update of the spatial relation only applicable to SRS resources configured by *SRS-Resource* (i.e. a resource configured for mimo).

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| **TP 2.3B**  ===================== Unchanged parts omitted =========================  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource-r16* is set to 'aperiodic':  ===================== Unchanged parts omitted =========================  - when a UE receives an spatial relation update command, as described in clause 6.1.3.26 of [10, TS 38.321], for an SRS resource configured with the higher layer parameter *SRS-Resource*, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set.  ===================== Unchanged parts omitted ========================= |

Companies are encouraged to provide their preference between TP2.3A, TP2.3B or other changes (if any) in the comment section below.

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| Company | Comment |
| vivo | Seems both TPs are addressing the same thing. We’re okay with the intention of either TP |
| OPPO | TP 2.3B is preferred since the wording is more aligned with the configuration of SRS. |
| Huawei/HiSilicon | Support either TP. |
| ZTE | Both TPs are OK. |
| CATT | Support TP 2.3B for better wording. |
| SS | Both are OK. |
| LG | Either TP 2.3A or TP2.3 B is fine |
| QC | Support either TP. |
| MTK | TP2.3B is slightly preferred |

Based on the current feedback, it seems that both TP could be agreed and that TP 2.3B has more explicit support. The following offline consensus is proposed:

**Proposal for offline consensus 1: TP 2.3B is endorsed.**

## 2.4 Aspect #17: UE Sounding Procedure - Alignment of Parameter Names

Two companies provided updates to the UE sounding procedure in 38.214 for the purpose of parameter alignment:

* in [[5], CATT] the TP (reproduced below as TP 2.4A) aims to align parameter names with RAN2 WG. Another issue in the above descriptions in section 6.2.1 is the ambiguity on the applicability of the higher layer parameter *cyclicShift-n8-r16* and *combOffset-n8-r16*. For the higher layer parameter *cyclicShift-n8-r16*, in fact, only two higher layer parameters *cyclicShift-n2* and *cyclicShift-n4* are applicable for the configuration of the cyclic shiftsof *SRS-MIMO.* The higher layer parameter *cyclicShift-n8-r16* is only applicable for SRS-Pos but not applicable for SRS-MIMO. However, the descriptions in the current section 6.2.1 in 38.214 mix these parameters together, which maybe cause some ambiguity on the applicability of the higher layer parameter *cyclicShift-n8-r16*. For the higher layer parameter *combOffset-n8-r16*, there is the similar issue.

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| **TP 2.4A**  *------------------------------------------Start of Text Proposal for 38.214--------------------------------------------------*  6.2.1 UE sounding procedure  *--------------------------------------------* Unchanged part omitted *--------------------------------------------------------*  The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource-r16*.  - *srs-ResourceId* or *SRS-PosResourceId-r16* determines SRS resource configuration identity.  - Number of SRS ports as defined by the higher layer parameter *nrofSRS-Ports* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, *nrofSRS-Ports* is 1.  *-* Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter *resourceType* or *resourceType-r16*, which may be periodic, semi-persistent, aperiodic SRS transmission as defined in Clause 6.4.1.4 of [4, TS 38.211].  - Slot level periodicity and slot level offset as defined by the higher layer parameters *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent, which configured by *SRS-Resource*, and *periodicityAndOffset-p*-*r16* or *periodicityAndOffset-sp-r16* for an SRS resource of type periodic or semi-persistent, which configured by *SRS-PosResource-r16*. The UE is not expected to be configured with SRS resources in the same SRS resource set *SRS-ResourceSet* or *SRS-PosResourceSet-r16* with different slot level periodicities. For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a slot level offset is defined by the higher layer parameter *slotOffset.* For an *SRS-PosResourceSet-r16* configured with higher layer parameter r*esourceType-r16* set to 'aperiodic', the slot level offset is defined by the higher layer parameter *slotOffset-r16* for each SRS resource.  - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter *resourceMapping* or *resourceMapping*-*r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *R* is not configured, then *R* is equal to the number of OFDM symbols in the SRS resource.  - SRS bandwidth and , as defined by the higher layer parameter *freqHopping* or *freqHopping*-*r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then= 0.  - Frequency hopping bandwidth, , as defined by the higher layer parameter *freqHopping* or *freqHopping*-*r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then = 0.  - Defining frequency domain position and configurable shift, as defined by the higher layer parameters *freqDomainPosition* and *freqDomainShift, or freqDomainPosition*-*r16* and *freqDomainShift*-*r16 respectively,* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *freqDomainPosition* or *freqDomainPosition*-*r16* is not configured, *freqDomainPosition* or *freqDomainPosition*-*r16* is zero.  - Cyclic shift, as defined by the higher layer parameter *cyclicShift-n2* or *cyclicShift-n4* for transmission comb value 2 or 4 for an SRS configured by *SRS-Resource*, respectively, and defined by the higher layer parameter *cyclicShift-n2-r16*, *cyclicShift-n4-r16, or cyclicShift-n8-r16* for transmission comb value 2, 4 or 8 for an SRS configured by *SRS-PosResource-r16*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb value as defined by the higher layer parameter *transmissionComb* or *transmissionComb-r16* described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb offset as defined by the higher layer parameter *combOffset-n2* or *combOffset-n4* for transmission comb value 2 or 4 for an SRS configured by *SRS-Resource*, respectively, and defined by the higher layer parameter *combOffset-n2-r16*, *combOffset-n4-r16*, or *combOffset-n8-r16* for transmission comb value 2, 4, or 8 for an SRS configured by *SRS-PosResource-r16*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - SRS sequence ID as defined by the higher layer parameter *sequenceId* or *sequenceId-r16* in Clause 6.4.1.4 of [4].  - The configuration of the spatial relation between a reference RS and the target SRS, where the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16*, if configured, contains the ID of the reference RS. The reference RS may be an SS/PBCH block, CSI-RS configured on serving cell indicated by higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise, or an SRS configured on uplink BWP indicated by the higher layer parameter *uplinkBWP* or *uplinkBWP-r16* , and serving cell indicated by the higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise. When an SRS is configured by the higher layer parameter *SRS-PosResourceSet-r16*, the reference RS may also be a DL PRS configured on a serving cell, an SS/PBCH block or a DL PRS of a non-serving cell indicated by a higher layer parameter.  *-------------------------------------------*Unchanged part omitted *---------------------------------------------------------*  *---------------------------------------------End of Text Proposal ----------------------------------------------------------* |

* In [[9], OPPO], it is proposed to align parameter names for UE sounding procedure Section 6.2.1 of TS 38.214
  + The following TP below is proposed:

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| **TP 2.4B** 6.2.1 UE sounding procedure \*\*\* Unchanged text is omitted \*\*\*  The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource-r16*.  - *srs-ResourceId* or *srs-PosResourceId-r16* determines SRS resource configuration identity.  - Number of SRS ports as defined by the higher layer parameter *nrofSRS-Ports* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, *nrofSRS-Ports* is 1.  *-* Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter *resourceType*, which may be periodic, semi-persistent, aperiodic SRS transmission as defined in Clause 6.4.1.4 of [4, TS 38.211].  - Slot level periodicity and slot level offset as defined by the higher layer parameters *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent. The UE is not expected to be configured with SRS resources in the same SRS resource set *SRS-ResourceSet* or *SRS-PosResourceSet-r16* with different slot level periodicities. For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a slot level offset is defined by the higher layer parameter *slotOffset.* For an *SRS-PosResourceSet-r16* with higher layer parameter r*esourceType-r16* set to 'aperiodic-r16', the slot level offset is defined by the higher layer parameter *slotOffset-r16* for each SRS resource.  - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter *resourceMapping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *R* is not configured, then *R* is equal to the number of OFDM symbols in the SRS resource.  - SRS bandwidth and , as defined by the higher layer parameter *freqHopping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then= 0.  - Frequency hopping bandwidth, , as defined by the higher layer parameter *freqHopping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then = 0.  - Defining frequency domain position and configurable shift, as defined by the higher layer parameters *freqDomainPosition* and *freqDomainShift, respectively,* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *freqDomainPosition* is not configured, *freqDomainPosition* is zero.  - Cyclic shift, as defined by the higher layer parameter *cyclicShift-n2*, *cyclicShift-n4, or cyclicShift-n8* for transmission comb value 2, 4 and 8, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb value as defined by the higher layer parameter *transmissionComb* or *transmissionComb-r16* described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb offset as defined by the higher layer parameter *combOffset-n2*, *combOffset-n4*, or *combOffset-n8* for transmission comb value 2, 4, or 8 respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - SRS sequence ID as defined by the higher layer parameter *sequenceId* or *sequenceId* -r16 in Clause 6.4.1.4 of [4].  - The configuration of the spatial relation between a reference RS and the target SRS, where the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16*, if configured, contains the ID of the reference RS. The reference RS may be an SS/PBCH block, CSI-RS configured on serving cell indicated by higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise, or an SRS configured on uplink BWP indicated by the higher layer parameter *uplinkBWP*, and serving cell indicated by the higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise. When SRS is configured by the higher layer parameter *SRS-PosResourceSet-r16* the reference RS may also be a DL PRS configured on a serving cell, an SS/PBCH block or a DL PRS of a non-serving cell indicated by a higher layer parameter.  \*\*\* Unchanged text is omitted \*\*\*  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16', or 'ssb-IndexNcell-r16' the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16* contains the ID of a reference 'srs' or 'srs-SpatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* contains the ID of a reference 'dl-PRS-ResourceId-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  \*\*\* Unchanged text is omitted \*\*\* |

Companies are encouraged to provide their preference between TP2.4A, TP2.4B or other changes (if any) in the comment section below.

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| Company | Comment |
| Nokia/NSB | Support TP2.4A. |
| vivo | support TP2.4A |
| OPPO | Support both A and B |
| Huawei/HiSilicon | From our side, when a field has both versions without suffix and with suffix –r16, and they serve the same functionality, we suggest to keep only the description for the fields without suffix to keep the spec clean, which by the way that is widely used in RAN2 spec.  Therefore, we prefer TP2.4B without the changes w.r.t. *transmissionComb* and *sequenceId*. |
| ZTE | Both TP2.4A and TP2.4B. |
| CATT | Support TP2.4A and the 2nd part of TP2.4B. The 1st part of TP2.4B is not complete when modifying the contents of this part.  For Huawei’s comments:  We cannot agree to Huawei’s comments on with suffix and without suffix, the wording in the specs should be clear and unambiguous, so we prefer to add the suffix –r16 for SRS-Pos related parameters. |
| SS | Both are acceptable |
| LG | Support TP2.4A |
| Huawei/HiSilicon | To us, we do not see any ambiguity for those parameter name without suffix, which has been used in LTE and NR, e.g. TS 36.211, TS 38.211.  For the sake of progress, we can agree with such a change for this meeting, however we strongly discourage this kind of change by enumerating the same field in different releases with the same meaning in the future meeting, otherwise they will come one meeing after another.  For SRS, we have the following description in TS 38.211, and I guess no one considers them as ambiguous.  6.4.1.4.2 Sequence generation  The sounding reference signal sequence for an SRS resource shall be generated according to        where is given by clause 6.4.1.4.3, is given by clause 5.2.2 with and the transmission comb number is contained in the higher-layer parameter *transmissionComb*. The cyclic shift  for antenna port  is given as  ,  where  is contained in the higher layer parameter *transmissionComb*. The maximum number of cyclic shifts are given by Table 6.4.1.4.2-1.  The sequence group and the sequence number  in clause 5.2.2 depends on the higher-layer parameter *groupOrSequenceHopping* in the *SRS-Resource* IE or the *SRS-PosResource-r16* IE*.* The SRS sequence identity  is given by the higher layer parameter *sequenceId* in the *SRS-Resource* IE, in which case , or the *SRS-PosResource-r16* IE, in which case . The quantity is the OFDM symbol number within the SRS resource. |
| Qualcomm | We dont agree doing spec changes that involved adding the same parameters with a different release number when the functionality is the same. So, either TP does not work for us. For the same functionality, we should **not** just repeat the field in RAN1 spec, unless it is really necessary because the functionality changes. So, we cannot accept either TP as they currently stand. |
| CATT | For Huawei’s comments, we remind companies should keep a precise attitude on the wording of specs. Every parameter names in the specs should be accurate and no ambiguity. However, current descirptions in the above sections mixed the names of parameters for SRS-Pos and SRS-MIMO. If we don’t correct such issues, there will be a misconception that SRS-Pos and SRS-MIMO use the same parameters, but in fact, they have different higher-layer parameter names and different candidate values, such as *periodicityAndOffset-p* and *periodicityAndOffset-p-16* have the following different values. If we only mention *periodicityAndOffset-p* in the specs, the reader maybe only useSRS-PeriodicityAndOffset for both SRS-MIMO and SRS-Pos, but not use SRS-PeriodicityAndOffset-r16 for SRS-Pos.  SRS-PeriodicityAndOffset ::= CHOICE {  sl1 NULL,  sl2 INTEGER(0..1),  sl4 INTEGER(0..3),  sl5 INTEGER(0..4),  sl8 INTEGER(0..7),  sl10 INTEGER(0..9),  sl16 INTEGER(0..15),  sl20 INTEGER(0..19),  sl32 INTEGER(0..31),  sl40 INTEGER(0..39),  sl64 INTEGER(0..63),  sl80 INTEGER(0..79),  sl160 INTEGER(0..159),  sl320 INTEGER(0..319),  sl640 INTEGER(0..639),  sl1280 INTEGER(0..1279),  sl2560 INTEGER(0..2559)  }  SRS-PeriodicityAndOffset-r16 ::= CHOICE {  sl1 NULL,  sl2 INTEGER(0..1),  sl4 INTEGER(0..3),  sl5 INTEGER(0..4),  sl8 INTEGER(0..7),  sl10 INTEGER(0..9),  sl16 INTEGER(0..15),  sl20 INTEGER(0..19),  sl32 INTEGER(0..31),  sl40 INTEGER(0..39),  sl64 INTEGER(0..63),  sl80 INTEGER(0..79),  sl160 INTEGER(0..159),  sl320 INTEGER(0..319),  sl640 INTEGER(0..639),  sl1280 INTEGER(0..1279),  sl2560 INTEGER(0..2559),  sl5120 INTEGER(0..5119),  sl10240 INTEGER(0..10239),  sl40960 INTEGER(0..40959),  sl81920 INTEGER(0..81919),  ...  }  As mentioned in our tdoc, another issue is the ambiguity on the applicability of the higher layer parameter *cyclicShift-n8-r16* and *combOffset-n8-r16*. For the higher layer parameter *cyclicShift-n8-r16*, in fact, only two higher layer parameters *cyclicShift-n2* and *cyclicShift-n4* are applicable for the configuration of the cyclic shiftsof *SRS-MIMO.* The higher layer parameter *cyclicShift-n8-r16* is only applicable for SRS-Pos but not applicable for SRS-MIMO. However, the descriptions in the current section 6.2.1 in 38.214 mix these parameters together, which maybe cause some ambiguity on the applicability of the higher layer parameter *cyclicShift-n8-r16*. For the higher layer parameter *combOffset-n8-r16*, there is the similar issue.  In order to solve above issues, we prefer to adopt the TP2.4A.  About Huawei’s example 6.4.1.4.2 in 38.211, we have to say the issues also exist in 38.211, and they had better to be fixed together. We also have one example on 38.211, which fixed the suffix issue in below: 6.4.1.4.4 Sounding reference signal slot configuration For an SRS resource configured as periodic or semi-persistent by the higher-layer parameter *resourceType*, a periodicity  (in slots) and slot offset  are configured according to the higher-layer parameter *periodicityAndOffset-p* or *periodicityAndOffset-sp* in the *SRS-Resource* IE, or *periodicityAndOffset-p-r16* or *periodicityAndOffset-sp-r16* in the *SRS-PosResource-r16* IE. Candidate slots in which the configured SRS resource may be used for SRS transmission are the slots satisfying    SRS is transmitted as described in clause 11.1 of [5, TS 38.213].  For Qualcomm’s comments, we think the functionality and candidate values of these parameters for SRS-MIMO and SRS-Pos is not the same, the detailed explanation can be found in the above. |
| MTK | It is kind of messy to add suffix. But it seems necessary to be clear. We are fine with CATT |

## 2.5 Aspect #18: Prioritization for Transmission Power Reduction

* In [[13], LGE] a TP (reproduced below as TP2.5A) is proposed for section 7.5 Prioritizations for transmission power reductions`

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| **TP2.5A**  *---- Unchanged parts omitted ----*  The total UE transmit power in a symbol of a slot is defined as the sum of the linear values of UE transmit powers for PUSCH, PUCCH, PRACH, and SRS in the symbol of the slot.  *---- Unchanged parts omitted ----*  - SRS transmission, with aperiodic SRS having higher priority than semi-persistent and/or periodic SRS, or PRACH transmission on a serving cell other than the Pcell  - SRS transmission, with SRS resource configured by *SRS-Resource* having higher priority than SRS resource configured by *SRS-PosResource-r16*  *---- Unchanged parts omitted ----* |

Companies are encouraged to provide their feedback on TP2.5A in the comment section below.

|  |  |
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| Company | Comment |
| Nokia/NSB | Support. |
| Vivo | Not support.  In our opinion, the power allocation issues when SRS for positioning is transmitted simultaneously with other signal is bigger than the solution of this proposed TP. For instance, should periodic SRS (for MIMO) always take priority over aperiodic SRS for positioning?  There’re many contributions for Rel-17 positioning SI discussing some priority among signals including power allocation. We think this issue in section 2.5 should be left to Rel-17 for a complete discussion. |
| OPPO | Not support  There is no motivation to specify that SRS for MIMO has higher priority than SRS for position or the other way. |
| Huawei/HiSilicon | We suggest not to support the enhancement at this stage. Note that below the text, there is additional priority between CCs (CC with PUCCH and without PUCCH, NUL and SUL) than also be used to address simultaneous SRS transmission between CCs. |
| ZTE | Not support. The issue can be discussed in Rel-17, since it’s more relevant to latency/priority enhancement. |
| CATT | Not support.  It seems like no sufficient arguments to support SRS-MIMO has higher priority than SRS-Pos. |
| LG | Support.  We understand it is difficult to discuss it at this stage, but the Rel-16 UE behavior is ambiguous when a total transmission power determined by the power control rule exceeds the maximum available power for simultaneous transmission of SRS resources. There is a simple motiviation to have high priority of SRS for MIMO since SRS for MIMO can also be resued for positioning purpose, so it has higher priority in case of simultaneous transmission.  We are open to discuss further issues such as consideraion of time-domain behaviour, NUL/SUL and so forth to complete the Rel-16 UE-behaviour for transmission of SRS for positioning. |
| Huawei/HiSilicon | In reply to LG, what SRS is in use for positioning depends on what SRS configuration is transferred to LMF and forwarded to the TRPs, which means that UE may transmit MIMO-SRS, but no TRP is listenning to it, instead they are listenining to the simultaneously transmitted positioning SRS. We suggest to the keep the current priority rule and any enhancement can be discussed in Rel-17. |
| Qualcomm | We consider it an enhancment at this stage, so we have preference to not support it. |
| MTK | Discuss this in Rel-17 |

## 2.6 Aspect #22: Priority of SRS for Positioning

* In [[5]], CATT] it is proposed to have higher priority for Aperiodic SRS-Pos than for PUSCH. In particular, the following proposals were made:
  + Aperiodic SRS-Pos should have a higher transmission priority than PUSCH, and PUSCH should be dropped in the overlapped symbols when colliding with aperiodic SRS-Pos.
  + Adopt the following text proposal (TP-D) for collision handling between SRS-Pos and PUSCH in section 6.2.1 of 38.214:

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| **TP2.6A**  *---------------------------------------------Start of Text Proposal for 38.211--------------------------------------------*  **6.2.1 UE sounding procedure**  *---------------------------------------------* Unchanged part omitted *---------------------------------------------------*  For PUCCH and SRS on the same carrier, a UE shall not transmit SRS when semi-persistent and periodic SRS are configured in the same symbol(s) with PUCCH carrying only CSI report(s), or only L1-RSRP report(s), or only L1-SINR report(s). A UE shall not transmit SRS when semi-persistent or periodic SRS is configured or aperiodic SRS is triggered to be transmitted in the same symbol(s) with PUCCH carrying HARQ-ACK, link recovery request (as defined in clause 9.2.4 of [6, 38.213]) and/or SR. In the case that SRS is not transmitted due to overlap with PUCCH, only the SRS symbol(s) that overlap with PUCCH symbol(s) are dropped. PUCCH shall not be transmitted when aperiodic SRS is triggered to be transmitted to overlap in the same symbol with PUCCH carrying semi-persistent/periodic CSI report(s) or semi-persistent/periodic L1-RSRP report(s) only, or only L1-SINR report(s).  For PUSCH and SRS on the same carrier, PUSCH shall not be transmitted when aperiodic SRS configured by the higher layer parameter *srs-PosResource-r16* is triggered to be transmitted to overlap in the same symbol with PUSCH.  *----------------------------------------------* Unchanged part omitted *------------------------------------------------------*  *-------------------------------------------End of Text Proposal ------------------------------------------------------------* |

Companies are encouraged to provide their feedback on TP2.6A in the comment section below.

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| --- | --- |
| Company | Comment |
| Nokia/NSB | We consider this an enhancement at this stage and suggest proponents to bring it to Rel-17 for discussion. |
| vivo | We had a similar proposal in previous RAN1 meeting. We support this in principle. However, as we mentioned in section 2.5, we think this whole priority issue should be discussed in details in Rel-17. |
| OPPO | Do not support the TP. That is a new enhancement and we shall not introduce new enhancement at later CR stage. It can be discussed in Rel-17. Furthermore, we do not think we can simply conclude that SRS for positioning always has higher priority than PUSCH. PUSCH has different types: URLLC PUSCH and eMBB PUSCH. Apparently, URLLC PUSCH shall not have lower priority than SRS. |
| Huawei/HiSilicon | Similar view to Nokia/NSB, vivo and OPPO. |
| ZTE | Not support. It’s an enhancement at CR stage. |
| CATT | If most of companies support to discuss this issue in Rel-17, we can accept not to pursue it in Rel-16. |
| SS | Agree with Nokia. |
| LG | Same view with Nokia |
| Qualcomm | Not support |

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| MTK | Discuss this in Rel-17 |

# Conclusion

TBD

# References

1. R1-2006996, Feature lead summary for NR positioning maintenance AI 7.2.8, Moderator (Intel), Ericsson, CATT, Qualcomm
2. R1-2005357, Remaining issues on DL RS for NR positioning vivo
3. R1-2005358, Remaining issues on physical layer procedure for NR positioning vivo
4. R1-2005452, Maintenance of NR positioning ZTE
5. R1-2005681, Remaining issues on DL PRS and measurements for NR Positioning CATT
6. R1-2005682, Remaining issues on UL SRS and UL procedures for NR Positioning CATT
7. R1-2005780, Discussion on QCL for PRS ZTE
8. R1-2005795, NR positioning corrections Huawei, HiSilicon
9. R1-2005806, RAN1 inputs to RAN3 on SRS support Huawei, HiSilicon
10. R1-2005978, Remaining Issues on measurements and procedure for NR Positioning OPPO
11. R1-2005979, Remaining Issues on RS for Positioning OPPO
12. R1-2006120, On remaining issues for Rel.16 positioning Samsung
13. R1-2006199, Remaining issues on DL PRS processing order CMCC
14. R1-2006372, Discussion on remaining issues on simultaneous SRS transmission and PRS processing priority for NR positioning LG Electronics
15. R1-2006373, Discussion on remaining issues on QCL and spatial relation information for NR positioning LG Electronics
16. R1-2006425, Maintenance on measurements for NR positioning Nokia, Nokia Shanghai Bell
17. R1-2006426, Priority of Assistance Data Nokia, Nokia Shanghai Bell
18. R1-2006784, Maintenance on DL Reference Signals for NR Positioning Qualcomm Incorporated
19. R1-2006911, Maintenance of rel16 reference signals for NR positioning Ericsson
20. R1-2006912, Maintenance of rel16 Physical-layer procedures to support UE - gNB measurements Ericsson